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July 30, 2020

Mr. Eric Joosten, Chairman
Environmental Protection Commission
2 Renshaw Road
Darien, Connecticut 06820

Re: Palladian Builders
49 Sunswyck Road
Darien, Connecticut

Dear Mr. Joosten and Members of the Environmental Protection Commission,

This is a follow up review after the submission of revised plans by the applicant. New comments are shown in bold.

**Executive Summary:**

1. While the proposed sewage disposal system does conform with the requirements of the CT Public Health Code Technical standards, it has not been demonstrated from an environmental standpoint that the system will not cause environmental impacts on the downgradient adjacent property or off-site wetland area. **Response: It is my professional opinion based upon data provided below that the proposed sewage disposal system on Lot #1 will cause an adverse impact to the downgradient wetlands by increasing the nitrogen load directed to it.**
2. The proposed stormwater management systems for proposed Lot #1 are not in compliance with the CT DEP 2004 Storm Water Quality Manual and the issues are clearly demonstrated below. **Response: The proposed Cultec system is not in compliance with the 2003 Darien Drainage Manual (town website) as the manual requires a 24" vertical separation to groundwater and the applicant is only providing 12".**
3. The stormwater management systems will not reduce the runoff volumes of the newly created impervious areas so as not to have adverse impacts on the adjacent downgradient property. **Response: The use of percolation test rate and not proper infiltration testing for the design and modeling of the Cultec systems means that they are likely undersized and will not function as intended.**

**Sewage Disposal Systems:**

1. As the proposed sewage disposal system is just 25' from the downgradient property line (per health code requirements) and the native soils are marginal, a renovation analysis performed in accordance with the CT DEP Design Manual needs to be done to ensure that all effluent directed to the system will be attenuated on Lot #1 prior to the downgradient property line. The analysis needs to ensure that the 21-day travel time for bacteria and viruses, there is adequate dilution of nitrogen to be 10 mg/l or less at the downgradient property line. **Response: I defined the nitrogen watershed for the proposed leaching system. The area to the property line is 0.145 acres, and the area to the wetland boundary is 0.185 acres. Using the nitrogen dilution analysis from the CT DEP Design Manual, the nitrogen concentration at the property line will be 16.3 mg/l and at the off-site wetland boundary will be 15.0 mg/l. Both values exceed 10 mg/l which needs to be met at either the downgradient property line, a wetland boundary or watercourse boundary. Thus, the proposed leaching system on Lot #1 will result in a substantial increase of nitrogen loading to the wetland. Increased nitrogen concentrations are a major concern in tidal environments which this is as increased nitrogen loads adversely impact wetland grasses in the tidal environment. As the system is entirely in fill, it is not appropriate to permeability rates for native soils to evaluate the 21-day bacteria travel time. Using a conservation permeability rate of 60 ft/day for sand/gravel select fill material, the 21-day travel time for bacteria will occur 36' downhill from the system, which is beyond the applicant's property line. If the actual permeability rate of the sand/gravel select fill is greater than 60 ft/day, the bacteria/virus die off will not occur prior to the wetland boundary.**

**Stormwater Management:**

1. Appendix A of the Site Engineering Report "Report" provides an Operations and Maintenance plan for the stormwater management systems proposed. There are no provisions for inspecting and maintaining the underground Cultec systems or Level Spreader discharge system. **Response: Applicant's response states that the gutters and distribution boxes for the underground Cultec systems will be done twice a year. What mechanism will guarantee that this work is done by the initial and future homeowners.**
2. There are no inspection manholes or other access points provided on the underground Cultec systems so if these systems do not function properly, there is no way to inspect or maintain them. **Response: If sediment and debris does wash into the Cultec system, how will this material be removed from the Cultecs through a 6" inspection port? Multiple 6" inspection ports are simply not adequate to fully maintain the underground Cultec systems.**
3. There is no pre-treatment system for the runoff being directed to either of the two Cultec systems, except for a catch basin prior to the system located in front of the house with has a 24" deep sump. This is inadequate to prevent the movement of suspended solids material from entering the Cultec system and accumulating in the stone layer under the Cultec system, thus reducing the void space within the stone. Reduction of void space

reduces the storage volume within this layer. **Response: Two-foot catch basins sumps will only reduce total suspended solids by 5% if they are cleaned out twice a year. With a hooded outlet, any trapped hydrocarbons must be removed by a qualified company and not a homeowner as the hydrocarbons are considered a hazardous waste product.**

4. The Water Quality Volume (WQV) for the impervious area on proposed Lot #1 has been provided, but it has not been shown by calculation that the WQV is being provided in the bottom of the Cultec system as stated by the applicant. **Response: Provided.**
5. The Groundwater Recharge Volume (GRV) per the CT DEP 2004 Storm Water Quality Manual has not be provided. It has not been demonstrated that the GRV will be fully infiltrated per the Manual which is the key to maintaining pre-development infiltration rates. **Response: While the GRV has been calculated, it questionable in my professional opinion if it will be fully infiltrated due the use of a percolation test and not the results from a Double Ring Infiltration test.**
6. The applicant is using the results of a percolation test (PT-101) as an infiltration rate for the underground Cultec system behind the house. This percolation test was conducted at a depth of 19", and the bottom of the Cultec system (in native soils is 27" below grade), thus the percolation is not representative of the infiltrative capacity of the soil under the Cultec system. **Response: See detailed comment below.**
7. Additionally, a percolation test measures both horizontal and vertical movement of water into the soil, so it is over-estimating the vertical infiltrative capacity of the soil which is used in the design of stormwater infiltration systems. A double ring infiltration test is the appropriate test to be done at or below the bottom of the infiltrative practice for the modeling of this type of system. **Response: Based upon a professional literature review, there is a substantial difference between the results of a percolation test. The actual vertical component of a standard percolation rate can be 25% to 50% of the observed percolation rate. So, in this case, the rate observed in the field was 3.2" per hour, thus the infiltration rate would be between 0.8"/hour or 1.6"/hr. When the 50% factor of safety per the DEP manual is applied, the rate used in the hydrologic model would be 0.4" to 0.8" which is significantly less than what was used by the applicant.**
8. As the true infiltration rate is less than that used by the applicant, the claims of reductions of peak rate will also change, and thus may not meet the Town of Darien requirements.
9. Per the DEP Manual, on page 11-P3-3, it states that the bottom of the infiltrative practice should be located at least 3' feet above the seasonal high groundwater table or bedrock as documented by on-site soil testing. **Response: See detailed comment below.**
10. For the Cultec system located behind the house on proposed Lot #1, there is only a 1.0' to 1.5' vertical separation from the bottom of the stone layer to observed mottling (indicator of seasonal high groundwater) where this system is located into original ground. The eastern end of the system is located 0.75' above the existing ground surface, but there is no test hole at this end of the system, so it cannot be confirmed that the 3' vertical separation is met. **Response: According to the Town of Darien Drainage Manual (2003), infiltration practices are discussed on in Section 9.6. There is no separate section for underground systems, such as Cultec or gallery. Section 9.6, on page 9-33 clearly states that the bottom of leaching trenches shall be a minimum of 24" above groundwater or bedrock. If a Cultec system is considered a Drywell, the**

**same vertical separations also apply according to page 9.40 of the manual. Thus the 12" vertical separation stated by the applicant is not correct.**

**11.** Based upon comment #10, the Cultec system as the rear of the house is not in compliance with the DEP Manual. **Response: Based upon the information found in the Darien Drainage Manual, the design of the Cultec system is not in compliance with Town Manual.**

12. The proposed pool is located only 1' or so from the northern edge of the rear Cultec system. While I understand is being shown for future possibilities, it does not appear that it can be constructed with adversely impacting the integrity of the Cultec system as the pool excavation would likely be deeper than the bottom of the Cultec system.

**13.** A sump pump for the footing drains will be used as the bottom of the foundation is located a minimum of 3' below the observed seasonal high groundwater table. The water from the footing drains will be discharged to the rear Cultec system. There has been no attempt to quantify the volume of runoff from the footing drains which would be directed to the Cultec system. The volume will vary substantially, typically being higher in the Spring and Fall than in summer. Additionally, snow melt will add to the groundwater in addition to rainfall. In the letter of June 22nd by DiVesta Civil Engineering Associates, it is stated that since infiltration will occur in this system, there will be plenty of room for the footing drain water. As stated above, the actual infiltrate runoff will be significantly less than what has been used in the hydrologic model so this statement cannot be confirmed. **Response: Concern expressed in this comment remains unaddressed in my professional opinion.**

**14.** The level spreader for the discharge of runoff from the rear Cultec system using a 4' x 4' timber placed into the ground on the downhill side of the stone filled trench to provide uniform flow across the length of the timber. However, there are several problems with this design, wood, even pressure treated wood rots overtime and decomposes, so at some point uniform flow will not occur, but will occur as concentrated flow at the low point. Additionally, the use of a timber and rebar (driven into the ground) will be subject to frost action and result in the movement of the timber up and down slightly which again affects the ability to ensure overland flow. Also, as the spreader is dead level, runoff can leave the system at the ends where there is no timber, thus leading to some degree of concentrated flow. **Response: A level spreader using a shallow wood beam as proposed here will be subject to frost action and once that occurs, the beam will no longer be level and thus overland flow from the gravel trench will convert to a concentrated discharge.**

15. If infiltration is not occurring then, the GRV has not been met. Additionally, there is no reduction of runoff volume. Runoff volume is the driver of potential downgradient flooding as typical detention systems only reduce the peak rate of runoff and do nothing to reduce the increase of volume associated increased impervious area.

**16.** There are no test holes or infiltration tests in the location of the Cultec system in front of the residence on proposed Lot #1, so it cannot be confirmed that the vertical separations to groundwater and/or bedrock are met per the DEP Manual. **Response: While the applicant has performed a percolation test in the area of the front Cultec, no deep test hole as been done, so this comment remains unaddressed.**

17. As the routing analysis for this Cultec system does not include infiltration, then there will be in increase of runoff volume directed to the wetland area on this parcel as well as the property owned by Malcolm Hall.
18. No evaluation of the potential impacts of the discharge of increased runoff volumes have been provided for the downgradient wetlands and property. **Response: As noted above, the infiltration used by the applicant is not valid in my professional opinion and based upon a literature review of the difference between percolation tests and Double Ring Infiltration tests, thus this issue remains unaddressed.**

Please contact my office if you have any questions concerning this information.

Respectfully Submitted,
Trinkaus Engineering, LLC


Steve Trinkaus, PE